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A CRT HAVING A SHADOW MASK VIBRATION DAMPER

Field of the Invention

[0001] This invention relates generally to cathode ray tubes (CRTs) and more particularly to a tension mask assembly having a vibration damper applied to an area of the tension mask.

Background of the Invention

[0002] A color cathode ray tube, or CRT, includes an electron gun for forming and directing three electron beams to a screen of the tube. The screen is located on the inner surface of the faceplate panel of the tube and is made up of an array of elements of three different color-emitting phosphors. A shadow mask, which may be either a formed mask or a tension mask having strands, is located between the electron gun and the screen. The electron beams emitted from the electron gun pass through apertures in the shadow mask and strike the screen causing the phosphors to emit light so that an image is displayed on the viewing surface of the faceplate panel.

[0003] One type of CRT has a tension mask comprising a set of strands that are tensioned onto a mask support frame to reduce their propensity to vibrate at large amplitudes under external excitation. Such vibrations would cause gross electron beam misregister on the screen and would result in objectionable image anomalies to the viewer of the CRT.

[0004] One method of tensioning a mask utilizes a mask support frame having a pair of support blade members mounted on opposite sides of the frame parallel to the major axis of the tension mask. The tension mask extends between the support blade members and is held in tension to reduce its propensity to vibrate. A problem exists in that the support blade members supporting the mask are subject to vibration relative to the frame when external vibration or microphonic vibration is applied to the

frame. Such external vibrations may then be undesirably transferred to the tension mask.

Summary of the Invention

[0005] The invention provides a CRT having a tension mask and a vibration damper to receive vibration from the tension mask. The tension mask is attached to a support frame, wherein the support frame has longs sides (22, 24) parallel to a major axis and shorts sides parallel to a minor axis (26, 28). The tension mask includes borders which are near the short sides and parallel therewith. The vibration damper comprises an elongated strip member having first and second ends mounted at respective attachment locations along the border and a major portion which is in frictional contact with the border.

Brief Description of the Drawings

[0006] The invention will now be described by way of example with reference to the accompanying figures of which:

[0007] Figure 1 is a cross sectional view of a CRT showing a tension mask support frame assembly.

[0008] Figure 2 is a perspective view of the tension mask support frame assembly.

[0009] Figure 3 is a partial perspective view of the lower corner portion shown in Figure 2.

[0010] Figure 4 is a partial perspective view similar to that of Figure 3 for a first alternate embodiment.

[0011] Figure 5 is a partial perspective view similar to that of Figures 3 and 4 for a second alternate embodiment of the invention.

[0012] Figure 6 is a cross sectional view taken along the line 6-6 of Figure 5.

[0013] Figure 7 is a partial sectional view similar to that of Figure 3 for a third alternate embodiment of the invention.

[0014] Figure 8 is a cross sectional view taken along the line 8-8 of Figure 7.

[0015] Figure 9 is a partial perspective view similar to that of Figure 3 showing a fourth alternate embodiment of the invention.

[0016] Figure 10 is a cross sectional view taken along the line 10-10 of Figure 9.

[0017] Figure 11 is a cross sectional view of a fifth alternate embodiment of the invention.

Detailed Description of the Invention

[0018] Figure 1 shows a cathode ray tube (CRT) 1 having a glass envelope 2 comprising a rectangular faceplate panel 3 and a tubular neck 4 connected by a funnel 5. The funnel 5 has an internal conductive coating (not shown) that extends from an anode button 6 toward the faceplate panel 3 and to the neck 4. The faceplate panel 3 comprises a viewing faceplate 8 and a peripheral flange or sidewall 9, which is sealed to the funnel 5 by a glass frit 7. A three-color phosphor screen 12 is carried by the inner surface of the faceplate panel 3. The screen 12 is a line screen with the phosphor lines arranged in triads, each of the triads including a phosphor line of each of the three colors. A tension mask support frame assembly 10 is removably mounted in predetermined spaced relation to the screen 12. An electron gun 13, shown schematically by dashed lines in Figure 1, is centrally mounted within the neck 4 to generate and direct three inline electron beams, a center beam and two side or outer beams, along convergent paths through the tension mask support frame assembly 10 to the screen 12.

[0019] The CRT 1 is designed to be used with an external magnetic deflection yoke 14 shown in the neighborhood of the funnel-to-neck junction. When activated, the yoke 14 subjects the three beams to magnetic fields which cause the beams to scan horizontally and vertically in a rectangular raster over the screen 12.

[0020] The tension mask support frame assembly 10, as shown in Figure 2, includes a frame 20 and a pair of support blade members 40 attached to the frame 20. The frame consists of two long sides 22 and 24, and two short sides 26 and 28 arranged in a plane for supporting a tension mask 30. The two long sides 22 and 24 of the frame 20 are parallel to a central major axis, X, of the CRT; and the two short sides 26 and 28 parallel a central minor axis, Y, of the CRT. The support blade members 40 are attached along the long sides 22 and 24 for supporting the tension mask 30 along blade edges 42 thereof. The mask 30 is shown in Figure 2 as a flat planar surface for simplicity. However, it consists of a plurality of apertures 32 as best shown partially in Figures 3.

[0021] Referring now to Figure 3, an exploded section of the tension mask frame assembly 10 is shown. The tension mask 30 is formed from a thin sheet of metal, typically steel or invar, which is etched or otherwise processed to produce a plurality of strands 32. Borders 36 located at opposite ends of the strands are attached to each of the support blade members 40 at an edge 42 by welding. The strands 32 extend parallel to the minor axis, Y, and a plurality of cross wires 34 are also conductive and are insulated from the strands 32 and extend parallel to the major axis, X. The combination of cross wires 32 and strands 34 form a plurality of precisely positioned apertures 35 through which the electron beam passes from the electron gun 13 to the screen 12. These apertures 35 define an array area 37 between the borders 36. Although the tension mask is firmly attached to and tensed between the support blade members 40, there is no ridged support along the minor axis, Y. The tension mask 30 is therefore somewhat susceptible to vibration transfer from the support blade members 40 to the tension mask 30.

[0022] The invention involves mitigating such vibrations through the use of at least one vibration damper 46, wherein a vibration damper 46 is provided along a border 36 of the tension mask 30 parallel to the minor axis Y and extending substantially between the long sides 22, 24. While only one vibration damper 46 will be described for simplicity, it should be understood that the preferred embodiment includes a pair of vibration dampers 46 each positioned along opposite ends of the tension mask 30 and damper 46 extends parallel to the minor axis Y. The vibration damper 46 is an elongated strip member which is attached to each of the borders 36 at an attachment location 48. The elongated strip member has first and second ends mounted to a surface along the border 36 of the tension mask 30 and a substantial portion acting upon the surface of the border 36. The first and second ends are attached to the surface of the border 36 at attachment locations 48. The attachment is preferably accomplished by welding but may also include attachment by adhesives or other suitable techniques. It should be understood that although the vibration damper 46 is shown here as being attached along a screen facing side of the mask 30, it could alternatively be applied to the opposite gun facing side of the tension mask 30. The vibration damper 46, while fixed at both ends is in rubbing frictional contact with the shadow mask 30 along a substantial portion of its surface between the attachment locations 48. As the tension mask 30 tends to vibrate, the vibrations are damped due to friction from the rubbing of the border 36 with the damper and induced strain energy along the damper 46. The vibrational energy of the mask 30 can be communicated to the borders 36 by either ties bars in a web-type mask or crosswires in a strand mask. The damper 46 may optionally have a rough surface applied on the side which is in contact with the tension mask 30 in order to increase the friction between these components upon vibration.

[0023] The material of the vibration damper 46 may be optionally selected to have a coefficient of thermal expansion which is different from that of the tension mask 30. Selection of such a material is preferred in applications where additional tensioning or detensioning is required along the minor axis Y of the tension mask 30 during thermal cycling. It should also be understood that while the vibration damper 46 is shown as being applied to a tension mask 30, it is equally applicable to other

types of masks such as shadow masks, tensed tie bar masks, focus masks and others.

[0024] Figure 4 shows a first alternate embodiment in which the vibration damper 46 is substantially similar to that shown in Figure 3 except that the attachment locations 148 are moved inward from the support blade member 40.

[0025] Figures 5 and 6 show a second alternate embodiment in which the vibration damper 46 is secured to the tension mask 30 by the application of a support plate 50 fastened to the vibration damper 46 through an opening 44 in the tension mask 30. As best shown in Figure 6, an adhesive 52 is applied to the vibration damper 46 at the attachment location 148 within the opening 44. The support plate 50 is then applied to the opposite side of the tension mask 30 such that it contacts the adhesive 52 through the opening 44 to sandwich the tension mask 30 between the vibration damper 46 and the support plate 50. It should be understood in this embodiment as with each of the others, that the vibration damper 46 may be positioned on either the gun facing side or the screen facing side of the tension mask 30 while the support plate 50 is positioned on the side opposite the vibration damper 46.

[0026] A third alternate embodiment is shown in Figures 7 and 8 wherein a support plate 50 is similarly positioned opposite the vibration damper 46 around the opening 44. In this embodiment, however, instead of applying an adhesive 52 at the attachment location 148, a pin 152 is utilized to secure the support plate 50 to the vibration damper 46. Once again, it should be understood in this embodiment as with each of the others, that the vibration damper 46 may be positioned on either the gun facing side or the screen facing side of the tension mask 30 while the support plate 50 is positioned on the side opposite the vibration damper 46.

[0027] Figures 9 and 10 show a fourth alternate embodiment in which the vibration damper 46 is applied to the tension mask 30 by simply bending a portion thereof through the opening 44. As best shown in Figure 10, a bent portion 49 extends through the opening 44 and around the opposite side of the tension mask 30

to sandwich the mask 30 between the bent portion 49 and the remainder of the vibration damper 46. It should be understood in this embodiment as with each of the others, that the vibration damper 46 may be positioned on either the gun facing side or the screen facing side of the tension mask 30 while the bent portion 49 is positioned on the side opposite the vibration damper 46.

[0028] Figure 11 shows yet a fifth alternate embodiment in which a raised portion 43 is formed into the vibration damper 46. Here, the raised portion 43 comprises a semicircular bent section extending outward from the vibration damper 46 and located near the attachment location 48 along the tension mask 30. The raised portion 43 is especially useful in situations where materials having different coefficients of thermal expansion are utilized for the vibration damper 46. The raised portion 43 serves to allow the vibration damper 46 to expand along with the tension mask 30 during thermal cycling without applying excessive shear forces to the attachment location 48. The raised portion (43) elastically maintains structural integrity of the elongated strip member. It should be understood that the raised portion 43 is optionally applicable to any of the alternate embodiments discussed above.

[0029] Advantageously, since the vibration damper 46 is in frictional contact with the tension mask 30 over a substantial portion of its surface, it serves to improve vibration damping of the tension mask 30 along the minor axis.